Unit 4.5 - Counting Principles - Day 2
Section 8.6
Fundamental Counting Principle

Evaluate.

$$\binom{6}{3} = {}_6C_3 = \frac{6!}{3!\,3!} = \frac{6\cdot5\cdot4\cdot\cancel{3\cdot2\cdot1}}{\cancel{3\cdot2\cdot1}\cdot3\cdot2\cdot1} = 20$$

$$\binom{12}{3} = {}_{12}C_3 = \frac{12!}{3!\,9!} = \frac{\overset{2}{\cancel{12}}\cdot11\cdot10}{\cancel{3\cdot2}\cdot1} = 220$$

$$\binom{9}{9} = {}_9C_9 = \frac{\cancel{9!}}{\cancel{9!}\,0!} = \frac{1}{1} = 1$$

FUNDAMENTAL COUNTING PRINCIPLE

If n independent events occur, with

m_1 ways for event 1 to occur.

m_2 ways for event 2 to occur.

.

.

.

and m_n ways for event n to occur.

then there are $m_1 \cdot m_2 \cdot \ldots \cdot m_n$

different ways for all n events to occur.

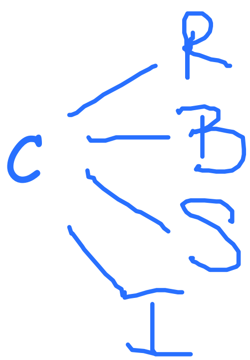
Using the Fundamental Principal of Counting

Counting Theory Handout

Composition of Cover: smooth, crinkled.
Lettering Style: Roman, block, script, italic

How many different choices are there?

$2 \times 4 = 8$



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Fundamental Counting Principle:

$2 \times 4 = 8$

Handout Example #1

A new economy car has just come on the market. To keep the price low, the manufacturer offers only the following options:

COLOR	ENGINE	TRANS.	RADIO
white	4 cylinders	manual	stereo, 4
red	6 cylinders	automatic	stereo, 8
blue			ster/cass, 4
			ster/cass, 8

$3 \times 2 \times 2 \times 4 = 48$

How many different choices are there?

The Buell Family ~~are~~ is lining up for a picture. How many different ways can they stand if they all stand in a line?

5 people

2 parents

3 children

$5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 120$

5 Buell

Suppose only 3 Buells are standing for a photo. In how many arrangements can they stand?

spot 1 spot 2 spot 3

$\underline{5} \cdot \underline{4} \cdot \underline{3}$

Suppose the 3 Buell's are standing for a photo, and two of the people must be a parent. In how many different arrangments ~~must~~ may they stand?

2   1   3 $= 6$

Suppose the 3 Buell's are standing for a photo, and one of the people must be a parent. In how many different arrangments ~~must~~ may they stand?

2   4   3 $2 \cdot 3 \cdot$

Suppose the 3 Buell's are standing for a photo, and two of the people must be a parent. In how many different arrangments must they stand?

Suppose a student id number consists of 6 digits and the first digit can not be 0. How many student numbers can be made?

# # # # # #

$9 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 = 900{,}000$

Suppose a student id number consists of 6 digits and the first digit can not be 0. No digits may repeat. How many student numbers can be made?

$9 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5$

Suppose a student id number consists of 6. The first digit can not be 0. All other digits must be even. How many arrangements?

$9 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5$

No Repeats? $9 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$

You are creating id numbers. There are six digits. The first 3 digits must be odd, no repeats. The last three digits must be even, no repeats. How many arrangements?

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$5 \cdot 4 \cdot 3 \cdot 5 \cdot 4 \cdot 3$

Homework

Counting Principles
Day 2
p 620-621: 7-12, 23-30